

Effect of clinical characteristics on terminal ileum length in right hemicolectomy for primary right colon adenocarcinoma

Terminal ileum length in right hemicolectomy

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Abstract

Aim: Although the severity of diarrhea, the number of defecations, disturbances in the absorption of bile salts in right hemicolectomy theoretically depend on the resected length of the terminal ileum, there is no international guideline on how much the terminal ileum can be resected. The aim of this study was to determine the length of the ileum removed in patients undergoing right hemicolectomy for primary right colon adenocarcinoma and to evaluate whether surgical urgency, tumor localization and patient characteristics affect the length of the ileum.

Material and Methods: We evaluated 145 patients who underwent right hemicolectomy for primary colon adenocarcinoma.

Results: The median resected ileum length of the patients included in the study was 6 cm (min:2-max:73). When ileum lengths were evaluated by subgroups according to T stage ($p=0.005$) and N stage ($p=0.005$), there was a significant relationship between them. When N stages were also evaluated, there was no significant relationship between NO-N1 stages, while there was a significant difference in ileum lengths between N1-N2 ($p=0.008$) and NO-N2 ($p=0.001$) stages.

Discussion: In this descriptive study, we investigated the factors that may explain the variability of ileum length in patients who underwent right hemicolectomy for primary right colon adenocarcinoma, with the idea that the length of the ileum resected during surgery does not have a certain standard.

Keywords

Right Colon Adenocarcinoma, Terminal Ileum, Tumor Invasion, Regional Lymph Nodes, Distant Metastases

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This study was approved by the Ethics Committee of Gazi University Faculty of Medicine (Date: 2023-01-23, No: 079)

Introduction

According to current information, colorectal cancers represent 10% of all cancer cases and contribute to mortality in a large patient population with 9.4% of cancer-related deaths [1]. Metabolic and physiologic events occurring in the gastrointestinal tract after colorectal adenocarcinoma surgeries have long been evaluated and screened with many assessment scales in the postoperative period and quality of life has been evaluated [2,3,4]. However, the changes and metabolic disorders in the human gastrointestinal system caused by left colon and rectal cancers in the foreground have been repeatedly screened and evaluated in the literature [5,6,7]. The right colon and terminal ileum segments of the gastrointestinal tract are the leading segments of the gastrointestinal tract in terms of absorption of enterohepatic circulation, vitamin B12 and minerals that are important for the vital functions of the human body [8]. In addition, bile acid reabsorption, which is one of the primary functions of the distal segment of the ileum adjacent to the ileocecal valve, causes diarrhea and disruption of bowel regularity in patients after surgery [9]. Resection of the ileocecal valve after surgery for right colon adenocarcinoma also contributes to this condition. Both of these conditions reduce the quality of life of these patients, affect their social life and impair their psychosocial status [8,10].

Literature on the length of the ileum to be included in right hemicolectomy for right colon cancer is restricted [11,12].

In this study, we aimed to evaluate the length of the ileum segment resected during surgery for right colon adenocarcinoma and the factors affecting this length, which we think have not been adequately evaluated in the literature and have remained in the background.

Material and Methods

In this study, 145 patients who underwent right hemicolectomy for primary colon cancer in the last five years at a tertiary health center were evaluated. This study was planned as a retrospective, cross-sectional and single-center experience study. The aim of the study was to determine the length of the terminal ileum removed after right hemicolectomy and to evaluate whether patient characteristics, surgical method and tumor localization affect this length. Patients who underwent right hemicolectomy for benign reasons and patients who underwent right hemicolectomy due to non-colon cancer invasion and metastasis were excluded from the study (Figure 1). The resected ileum lengths of the patients were scanned and surgical approach methods of the patients were revealed. The lengths of the resected ileum segments were compared according to the TNM staging system of the American Joint Committee on Cancer (AJCC) [13].

Study approval was obtained from the Gazi University Faculty of Medicine Ethics Committee with the decision dated 23-01-2023 and numbered 079. The study protocol complies with the Declaration of Helsinki.

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) (version 26.0, SPSS Inc, Chicago, IL, USA) program. Besides descriptive statistical

methods (median, frequency, rate), the Kruskal-Wallis test was used to compare quantitative data, and the Mann-Whitney U test was used for two-group comparisons. Pearson's chi-squared test and Fisher's exact test were used to compare qualitative data. $P < 0.05$ was considered statistically significant. Fisher's exact post-hoc test was used to determine differences between groups.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

There were a total of 145 patients, 87 males (60%) and 58 females (40%), who met the inclusion criteria. The median age of the patient population was 66 years (min:29-max:91). The length of the ileum specimen included in the specimen was 6.0 (min:2-max:32.5) cm in the female group and 6.2 (min:2-max:73) cm in the male group, with no significant difference ($p = 0.745$).

Patients were evaluated according to the localization of colon adenocarcinoma, TNM stages and tumor differentiation. According to the localization of colon adenocarcinoma, in patients with caecum localization (43.4%), the median length of ileum specimen included in the specimen was 7.0 (min:2 max:73) cm, those localized in the ascending colon ($n = 44$ (30.3%)) were 5.0 (min:2-max:13) cm, and those located in the hepatic flexure (26.2%) were 6.0 (min:2-max:55) cm. When these groups were evaluated with the Kruskal-Wallis test, a significant difference was observed ($p = 0.012$). When divided into T1 ($n = 7$), T2 ($n = 22$), T3 ($n = 75$) and T4 ($n = 41$) groups according to T stages, there was a significant difference between the ileum lengths included in the specimen ($p = 0.005$) (Table 1). When we divided into N0 ($n = 73$), N1 ($n = 46$) and N2 ($n = 26$) groups according to N stages, a significant difference was observed between the ileum lengths included in the specimen ($p = 0.005$). Then, when the N stage groups were evaluated post-hoc within themselves with the Mann-Whitney U test, there was no significant difference between the ileum lengths included in the specimen in the N0 (median 6.0 (min:2-max:73) cm) and N1 (median 6.0 (min:2-max:55) cm) groups ($p = 0.73$). There was a significant difference between N1 and N2 (median 8.5 cm) groups ($p = 0.008$) and

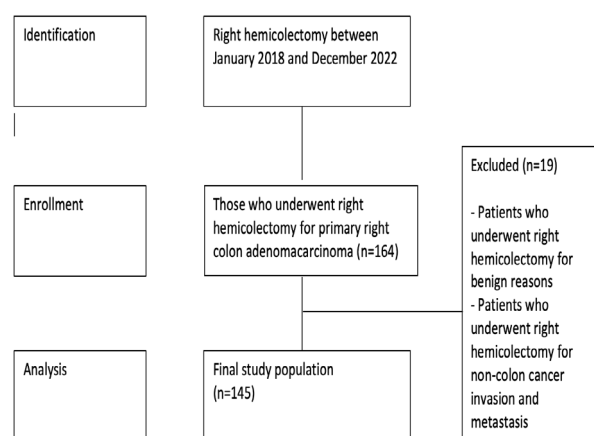


Figure 1. The sample collection scheme.

Table 1. Effect of clinicopathological characteristics of patients who underwent right hemicolectomy on the length of the ileum included in the specimen.

| | | Subheadings of terminal ileum specimen lengths (Median), (range), cm | p= |
|------------------------------|-----------------------------|--|----------------|
| | Number of patients, n | 145 | |
| Patients | Age (Median), (range), year | 66 (29-91) | 6.0 (2-73) |
| | Sex, n (%) | Female 58 (40%) | 6.0 (2-32.5) |
| | | Male 87 (60%) | 6.2 (2-73) |
| Location of cancer, n (%) | Hepatic flexure | 38 (26.2%) | 6.0 (2-55) |
| | Ascending colon | 44 (30.3%) | 5.0 (2-13) |
| | Caecum | 63 (43.4%) | 7.0 (2-73) |
| Primary tumor, n (%) | T1 | 7 (4.8%) | 4.0 (2-6) |
| | T2 | 22 (15.2%) | 5.0 (2.5-20) |
| | T3 | 75 (51.7%) | 6.5 (2-73) |
| | T4 | 41 (28.3%) | 7.0 (2-67) |
| Regional lymph nodes, n (%) | N0 | 73 (50.3%) | 6.0 (2-73) |
| | N1 | 46 (31.7%) | 6.0 (2-55) |
| | N2 | 26 (17.9%) | 8.5 (4-67) |
| Distant Metastases, n (%) | M0 | 123 (84.8%) | 6.0 (2-73) |
| | M1 | 22 (15.2%) | 6.7 (2-27) |
| Tumor differentiation, n (%) | Well differentiated | 57 (39.3%) | 5.5 (2-20) |
| | Moderately differentiated | 74 (51.0%) | 7.0 (2-73) |
| | Poorly differentiated | 14 (9.7%) | 6.0 (3-41) |
| Surgical approach, n (%) | Open | 135 (93.1%) | 6.0 (2-73) |
| | Laparoscopic | 9 (6.2%) | 7.0 (3.2-10.5) |
| | Robotic | 1 (0.68%) | 16 (16-16) |
| Urgency, n (%) | Emergency surgery | 35 (24.1%) | 8.0 (2-73) |
| | Elective surgery | 110 (75.9%) | 6.0 (2-67) |

n: number, T1: tumor invades submucosa, T2: tumor invades muscularis propria, T3: 'tumor invades through the muscularis propria into pericolorectal tissues, T4: tumour penetrates to the surface of the visceral peritoneum or tumor directly invades or is adherent to other organs or structures, N0: no tumour invasion into regional lymph nodes, N1: tumour cells found in one regional lymph node, N2: tumour cells found in four regional lymph nodes or more, M0: no spread to a distant part of the body, M1: cancer spread to one other part of the body beyond the colon or rectum, cm: centimetres.

Table 2. Relationship between N stage and the length of the ileum included in the specimen in right hemicolectomy.

| Regional lymph nodes, n (%) | Subheadings of terminal ileum specimen lengths (Median), (range), cm | p= |
|-----------------------------|--|-------|
| Group N0, 73 (50.3%) | 6.0 (2-73) | 0.73 |
| Group N1, 46 (31.7%) | 6.0 (2-55) | |
| Group N1, 46 (31.7%) | 6.0 (2-55) | 0.008 |
| Group N2, 26 (17.9%) | 8.5 (4-67) | |
| Group N0, 73 (50.3%) | 6.0 (2-73) | 0.001 |
| Group N2, 26 (17.9%) | 8.5 (4-67) | |

n: number, cm: centimeters, N0: no tumour invasion into regional lymph nodes, N1: tumor cells found in one regional lymph node, N2: tumor cells found in four regional lymph nodes or more.

between N0 and N2 groups ($p=0.001$) (Table 2). When we divided the tumor into three groups according to tumor differentiation as good, moderate and poor differentiation, there was no significant difference between the resected terminal ileum lengths according to the degree of differentiation ($p=0.029$). Patients were then classified according to surgical method and the urgency of surgery. According to the surgical method, the patients were divided into three groups: robotic ($n=1$), laparoscopic ($n=9$) and open ($n=135$) surgery. There was no significant difference between the length of ileum included in the specimen in patients who underwent robotic (median 16

cm), laparoscopic (median 7.0 cm) and open (median 6.0 cm) surgery ($p=0.317$). When classified according to surgical urgency, 35 (24.1%) patients were included in the emergency surgery group and 110 (75.9%) patients were included in the elective surgery group. The median ileum length included in the specimen in the emergency surgery group was 8.0 (min:2-max:73) cm, while the median ileum length in the elective surgery group was 6.0 (min:2-max:67) cm. There was a significant difference between both groups in terms of ileal length ($p=0.007$) (Table 1).

Discussion

In this descriptive study, we investigated the factors that may explain the variability of ileum length in patients who underwent right hemicolectomy for primary right colon adenocarcinoma, with the idea that the length of the ileum resected during surgery does not have a certain standard.

A review of the current literature did not reveal extensive and well-validated data on the length of the resected ileum. The literature was mostly related to B12 malabsorption due to resection of the ileocecal valve, magnesium malabsorption, bile acid malabsorption, diarrhea, which affects the long-term quality of life and has an impact on the social status of postoperative patients, and impaired defecation patterns compared to the preoperative period [8,9,10,14]. These studies evaluating

malabsorption were representative of studies on Chron's disease rather than primary right colon adenocarcinomas [15]. In the literature, we encountered a study with ideas close to our hypothesis. Ismail FQ et al., [12] evaluated all patients who underwent right hemicolectomy and found a significant relationship between the length of resected ileal specimens and BMI only. However, no significant association was found with surgical approach. In our data, we found no correlation between surgical approach and resected ileal specimen length ($p=0.317$). In the aforementioned study and in our study, tumor localization was found to be a factor affecting ileal specimen length. This may be explained by the fact that surgeons prefer to resect more ileum segments as the tumor localization approaches the ileum.

We think that one of the most important parameters for the surgeon to determine the resection margins in the intraoperative period and to achieve negative surgical margins in oncologic surgery is the characteristics of the tumor itself. In our hypothesized study, when we subdivided the primary adenocarcinomas of the right colon according to the TNM staging system [13] of the AJCC group, which is accepted in the literature, and evaluated the length of the ileum specimen, we found that T stage ($p=0.005$) and N stage ($p=0.005$) were significant, but M stage ($p=0.349$) was not significant.

However, when we evaluated according to surgical urgency, there was a significant difference between the ileum specimen lengths of patients who underwent resection for urgent reasons (median value 8.0 (min:2-max:73) cm) and patients who underwent oncologic surgery under elective conditions (median value 6.0 (min:2-max:67) cm) ($p=0.007$).

Conclusion

In conclusion, we found that tumor T stage, tumor N stage and type of surgical urgency are the factors that may affect the length of ileum specimens included in the specimen in primary right colon adenocarcinomas. If future studies can determine the interaction of the change in ileum specimen lengths with functional evaluations in patient follow-up, this may contribute to the current literature regarding the length of the ileum specimen to be resected.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of interest

The authors declare no conflict of interest.

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